Experimental Inquiries relative to the Distribution and Changes of the Magnetic Intensity in Ships of War. By George Harvey, *Esq. Communicated by* John Barrow, *Esq. F.R.S.* Read Feb. 26, 1824. [*Phil. Trans.* 1824, *p.* 310.]

This paper contains the details of experiments made on board several vessels, with a view of determining the influence of the iron in the ships upon the compass under different circumstances and situations. The instrument used for determining the intensity consisted of a magnetized cylindrical bar, 2·5 inches long and three eightieths of an inch diameter, delicately suspended by a single fibre of the silkworm, to the extremity of an adjusting screw, which worked in the cap of the glass vessel inclosing the bar. A brass wire also passed through the cap for the purpose of placing the bar at right angles to the magnetic meridian previous to its being put into a state of oscillation.

On the days devoted to the experiments on ship-board, the time of making 50 vibrations of the bar was determined in the centre of a meadow, of which the substratum was dry slate, by a mean of six sets of experiments, the time being accurately registered to quarter seconds. The instrument was then taken on board, and placed in succession at the different stations of the ship, and the mean of six sets of experiments determined at each station with the same precautions as on land. The times, says the author, of performing the oscillations on shore, and at each of the assumed points in the ship, necessarily gave the magnetic intensity at each station in terms of the terrestrial intensity, which in this case was represented by 100.

Experiments on the Elasticity and Strength of Hard and Soft Steel. In a Letter to Thomas Young, *M.D. For. Sec. R.S. By Mr.* Thomas Tredgold, *Civil Engineer.* Read March 25, 1824. [*Phil. Trans.* 1824, *p.* 354.]

The bars of steel used in these experiments were supported at the ends by two blocks of cast iron, resting upon a wooden frame, and a scale for weights was suspended from the middle of the length of the bar, by a cylindrical steel pin, three eighths of an inch in diameter. To measure the flexure a quadrantal piece of mahogany was attached to the frame, with a vertical bar sliding in two guides at its edge, and moving an index. The bar and index were so balanced, that one end of the bar bore with constant pressure upon the specimen, and the graduated arc was divided into inches, tenths, and hundredths. The thousandths were measured by a vernier. A bar of blistered steel of file hardness, 13 inches long between the supports, underwent no permanent alteration of form when loaded with 110lbs. The temper of the bar was then successively lowered, and it was ultimately again hardened; but in these different states its flexure and resistance to permanent change of form remained the same.

These experiments were repeated with bars of other dimensions, which were loaded till they broke; and from them the author also infers that the elastic force of steel is not altered by temper, and that the force which produces permanent alteration is to that which causes fracture in hard steel, as 1 : 1·66; and in the same steel of a straw yellow temper, as 1 : 2·56. From comparisons of the strain required to cause permanent alteration in different kinds of steel, the author concludes, that in the process of hardening, the particles are put into a state of tension among themselves, which lessens their power to resist extraneous force; and the phenomena of hardening may be referred to the more rapid abstraction of heat from the surface of the metal than can be supplied from the internal parts, whence a contraction of the superficial parts round the expanded central ones, and a subsequent shrinking of the latter, by which the state of tension is produced.

A short Account of some Observations made with Chronometers, in two Expeditions sent out by the Admiralty, at the recommendation of the Board of Longitude, for ascertaining the Longitude of Madeira and of Falmouth. In a Letter to Thomas Young, *M.D. For. Sec. R.S. and Secretary to the Board of Longitude. By Dr.* John Lewis Tiarks. Read April 29, 1824. [*Phil. Trans.* 1824, *p.* 360.]

Dr. Tiarks was sent to Madeira in the year 1822 with 15 chronometers, of which the rates had principally been ascertained in the Royal Observatory of Greenwich; he touched at Falmouth both in going out and returning; and having again ascertained the rates of his time-keepers, he was thus enabled to obtain two distinct determinations of the longitude of Falmouth, which differed about four seconds of time from that which had been inferred from the Trigonometrical Survey of Great Britain. It became therefore desirable that some further operations should be undertaken for the removal or elucidation of this discordance; and the following year a similar method was adopted with 25 chronometers, for determining the difference of longitude between Falmouth and Dover; this latter station having been chosen as easy of access, and as being perfectly determined; and the computations were made by interpolation, without employing any other rates for the chronometers than those which were observed in the different trips while they were actually on board the ship; and latterly, when Dover Roads became unsafe, the operations were limited to the distance from Portsmouth to Falmouth: thus, between the months of July and September, the observations were made three times at Dover, four times at Falmouth, and three times at Portsmouth; and the comparison of their results affords a correction of five seconds of time for the difference of longitude of Dover and Falmouth, and of three for the difference of Falmouth and Portsmouth, agreeing completely with the error of four seconds, attributed from the observations of the preceding year to the difference of longitude of Falmouth and Greenwich.